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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/824,602	04/02/2001	Susan S. Young	82297WFN	1205

7590 02/11/2004

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EXAMINER	
TUCKER, WESLEY J	

ART UNIT	PAPER NUMBER
2623	4

DATE MAILED: 02/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/824,602	YOUNG, SUSAN S.	
	Examiner	Art Unit	
	Wes Tucker	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 April 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) *16* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 April 2001* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2,3*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-15, drawn to image filtering and edge enhancement, classified in class 382, subclass 260 and 266.

II. Claims 16, drawn to extracting an image portion from an outline, classified in class 382, subclass 282.

Inventions I and II are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention II has separate utility such as determining a potion of an image to be extracted by determining an outline. See MPEP § 806.05(d).

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Susan Parulski on 2/2/04 a provisional election was made without traverse to prosecute the invention of claims 1-15. Affirmation of this election must be made by applicant in replying to this office action. Claim 16 is withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 8, 10, and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 6,285,798 to Lee.

3. With regard to claim 8, Lee discloses a method of enhancing high contrast details of an input image for rendering it effectively on an output display medium comprising:

constructing a tone scale curve from the input image (Fig. 2, element 40);

applying a tone scale curve to the input image to produce a tone scaled image (Fig. 3, and column 6, lines 42-45);

applying a decomposition filter bank to the tone-scaled image to produce the low-pass tone-scaled image (Fig. 2, element 20);

applying the decomposition filter bank to the input image to produce the high-passed input image in each spatial scale (Fig.2, elements 10 and 20, column 11, lines 50-54);

generating the contrast weight control signals from the high-passed input image in each spatial scale (Fig.2, element 30);

adjusting the high-passed input image in each scale according to said contrast weight control signals (Fig.2 elements W and W'); and,

applying a reconstruction filter bank to the low-pass tone-scaled image and the adjusted high-pass input image to produce a contrast enhancement presentation image for rendering on an output display medium (Fig. 2, element 50).

4. With regard to claim 10, Lee discloses the method according to claim 8, wherein said generating contrast weight control signals includes:

applying a decomposition filter bank to the input image to produce a high-passed input image at a coarse scale (column 11, lines 50-54);

computing a gradient amplitude of the high-passed input image at the coarse scale (column 10, lines 29-34);

creating a mapping function that the output value T is large when the gradient amplitude at the coarse scale is moderate and the output value T is small when the gradient amplitude at the coarse scale is very small and very large (column 10, line 66 - column 11, line 15). Here T is considered equivalent to V. V is large when the gradient amplitude is small.

Lee further discloses creating a mask image of the weight factor G such that G produces large gain factors for the pixels in each scale whose corresponding gradient amplitudes at the coarse scale having large T values and small gain factors for the pixels in each scale whose corresponding gradient amplitudes at the coarse scale having small T values (column 10, line 66 - column 11, line 15). Here V is interpreted as T and G is interpreted as G1, G2, ...Gn.

5. With regard to claim 14, Lee discloses the method according to claim 8, wherein the high-pass filters used in the decomposition filter bank are edge detectors at different spatial scales (column 11, lines 48-54).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 4, 5, 11, 13, and 15, are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,285,798 to Lee.

7. With regard to claim 1, Lee discloses method for improving images using contrast enhancement presentation comprising:

providing an input digital diagnostic image; applying a decomposition filter bank to the input digital diagnostic image (Fig. 2, element 10);

constructing a tone scale curve from the input digital diagnostic image (Fig. 2, element 40);

applying said tone scale curve to the input digital diagnostic image to produce a tone-scaled image (Fig. 3, and column 6, lines 42-45);

applying a decomposition filter bank to the tone-scaled image (Fig. 2, element 20);

generating the contrast weight control signals from the input digital diagnostic image by extracting the high contrast edge signals at the coarse scale (column 10, lines 28-32);

adjusting the decomposition outputs from both the input image and the tone-scaled image according to the contrast weight control signals (Fig. 2, elements 10, 20, 30, and 40);

and applying a reconstruction filter bank to the adjusted signals to produce a contrast enhancement presentation output image (Fig. 2, element 50).

Lee does not explicitly state that his method is used for disease or more specifically for breast cancer diagnosis. However he does state that his invention is used to enhance image contrast in

mediums where wide dynamic ranges suffer significant loss in detail such as radiography (column 1, lines (26-32). He also discusses edge banding as a dangerous and objectionable artifact in radiographic images (column 2, lines 1-5). It is well known in the art that contrast enhancement is important to mammography in detecting disease and/or breast cancer. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use the contrast enhancement method of Lee to enhance contrast in radiographic images for the purpose of detecting disease or breast cancer.

With regard to claim 4, the discussion of claim 1 applies.

8. With regard to claim 5, Lee discloses the method of claim 1 wherein said applying a decomposition filter bank to said input digital diagnostic image includes processing said image through a plurality of a pair of forward and reversed low pass, band pass and high pass filters (column 12, lines 7-17). Here the filter Fi is the forward filter direction since it is used to decompose and Hi is the reversed filter direction since it is used in order to reconstruct. Three frequency bands are used and they are interpreted as the low, band, and high-pass filters.

9. With regard to claim 11, Lee discloses a method of enhancing high contrast details of an input image for rendering it effectively on an output display medium comprising;

constructing a tone scale curve from the input image (Fig. 2, element 40);

applying the tone scale curve to the input image to produce the tone-scaled image (Fig. 3, and column 6, lines 42-45);

applying a decomposition filter bank to the tone-scaled image to produce a low-pass tone-scaled image and a high-pass tone-scaled image in each spatial scale (Fig.2, elements 10 and 20, column 11, lines 50-54);

applying a decomposition filter bank to the input image to produce a high-pass input image at a coarse scale; generating contrast weight control signals from the high-passed input image at the coarse scale and the high-passed tone-scaled image in each spatial scale (Fig. 2, element 20, column 11, lines 50-54);

adjusting the high-passed tone-scaled image in each scale according to the contrast weight control signals (Fig.2 elements W and W'); and

applying a reconstruction filter bank to the low-pass tone-scaled image and the adjusted high-pass tone-scaled image to produce a contrast enhancement presentation image (Fig. 2, element 50). Lee discloses both high pass and low pass filters (column 10, lines 38-42 and column 11, lines 50-54). In a filter bank it would be desirable to have both high and low pass filters according to the desirable filtering operation. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use either low-pass, high-pass, or band-pass filters depending on the desired effect of the filtering bank.

10. With regard to claim 13, Lee discloses the method according to claim 11, wherein said generating the contrast weight control signals includes:

applying a decomposition filter bank to the input image to produce a high-passed input image at a coarse scale (column 11, lines 50-54);

computing a gradient amplitude of the high-passed input image at the coarse scale (column 10, lines 29-34);

creating a mapping function that the output value T is large when the gradient amplitude at the coarse scale is moderate and the output value T is small when the gradient amplitude at the coarse scale is very small and very large (column 10, line 66 - column 11, line 15). Here T is considered equivalent to V. V is large when the gradient amplitude is small.

Lee further discloses creating a mask image of the weight factor G such that G produces large gain factors for the pixels in each scale whose corresponding gradient amplitudes at the coarse scale having large T values and small gain factors for the pixels in each scale whose corresponding gradient amplitudes at the coarse scale having small T values (column 10, line 66 - column 11, line 15). Here V is interpreted as T and G is interpreted as G1, G2, ...Gn.

11. With regard to claim 15, Lee discloses the method according to claim 11. wherein the high-pass filters used in the decomposition filter bank are edge detectors at different spatial scales (column 11, lines 48-54).

12. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of U.S. Patent 6,285,798 to Lee and U.S. Patent 5,467,404 to Vuylsteke et al.

13. With regard to claim 2, Lee discloses a method for improving disease diagnosis using mountain-view presentation comprising:

providing an input digital diagnostic image (Fig. 2, element I);

applying a decomposition filter bank to said digital diagnostic image to produce high contrast edge signals (column 10, lines 27-32);

Lee does not disclose outputting a mountain-view presentation image having mountains and plateaus wherein mountains are the areas containing high contrast edges and plateaus are the areas containing low frequency components. Vuylsteke discloses a "mountain-view" presentation (Figs. 10A and 10B). Fig. 10A is a plot of a line in an original image and 10B is a plot of that same line after the image has been contrast enhanced (column 14, lines 10-14). Vuylsteke teaches that the contrast of subtle details will show improved perceptibility in comparison with the original image. Therefore it would have been obvious to one of ordinary skill in the art to use the plotted presentation as taught by Vuylsteke with the enhanced image of Lee in order to improve perceptibility of enhanced contrast.

With regard to claim 3, the discussion of claim 2 applies.

14. Claims 6, 7, 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of U.S. Patent 6,285,798 to Lee and U.S. Patent 6,611,627 to LaRossa et al.

15. With regard to claim 6, Lee discloses the method according to claim 1, wherein said constructing a tone scale curve includes applying the decomposition filter bank to the input image to produce a high-passed input image at a coarse scale (column 11, lines 50-54), and computing the gradient amplitude of the high-passed input image at a coarse scale (column 10, lines 29-32 and lines 59-65). Here Lee discloses extracting high frequency data and suppressing low frequency data. Lee then discloses calculating edge gradient amplitude on coarse scale detected edges.

Lee does not disclose computing a binary edge map image where value 1 represents the pixel being the local maximum gradient magnitude along the gradient direction and value 0 represents other pixels. LaRossa discloses a method for edge shaping in which a binary edge map is computed

by locating directional local maximum points on the image gradient (column 7, lines 13-16). Computing such an edge map is well known in the art. The choice of representing the pixels as 1 or 0 is a design choice and it is inherent that they be represented in binary form. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to compute a binary edge map from the local maximum gradients as taught by LaRossa in the edge enhancement of Lee.

Lee does not disclose computing an image pattern histogram from the pixels belonging to the edge map with value at a coarse scale. LaRossa discloses determining a gradient and computing a histogram from the image gradient (column 6, lines 58-63). Although LaRossa does not use a binary edge map to compute the histogram, he determines a histogram from the gradient, which is used to compute the binary edge map. The effect is similar in determining a histogram depicting edge occurrence. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use a binary edge map or directly use the gradient as taught by LaRossa in the edge enhancement of Lee in order to determine a histogram to represent edge occurrence.

Lee discloses finding a range that covers the most effective code values in the image pattern histogram (column 6, lines 50-56). Here the range is interpreted as the three tone slopes for the image determined from the histogram because they represent the most effective code range values.

Lee further discloses constructing the tone scale curve from the found range (column 6, lines 54-56).

16. With regard to claim 7, Lee discloses the method according to claim 1, wherein said generating the contrast weight control signals include:

applying the decomposition filter bank to the input image to produce a high-passed input image at a coarse scale (column 11, lines 50-54);

computing an image gradient amplitude of the high-passed input image at the coarse scale (column 10, lines 29-34); and

constructing a mask image weight factors W such that W produces larger gain factors when the gradient amplitude at the coarse scale is moderate and smaller gain factors when the gradient amplitude at the coarse-scale is very small and very big (column 10, line 66 - column 11, line 15). Here the mask image factor is V and it is used to produce lower gain factors when gradient amplitude is large.

With regard to claim 9, the discussion of claim 6 applies

With regard to claim 12, the discussion of claim 6 applies.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wes Tucker whose telephone number is 703-305-6700. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wes Tucker
2-4-04

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